Introduction

The following curricular materials are the work of many District of Columbia teachers and administrators who were committed to developing useful tools to help teachers understand and effectively use the school district's new learning standards. The Office of Academic Services oversaw the development of this guide.

The learning standards specify what students should know and be able to do at the end of each grade level or course. Students are held responsible for learning standards listed at earlier grades, as well as for those listed at their current grade. The learning standards are now driving all instruction, assessment, and staff development in the district.

Organization of the Document

This curriculum guide is a companion to the pre-K through grade 12 standards documents — one each for reading/English language arts, mathematics, science, and social studies. Those documents allow teachers, students, administrators, parents, and others to see the learning standards *across all the grades*. With that guide, for instance, a 3rd grade teacher can see which standards the student should have mastered in grade 2 and earlier — and which standards will need to be mastered in grade 4 and beyond.

This guide, by contrast, looks only at the standards for a single grade or subject, but it adds additional depth to help teachers better understand the standards and know how to teach and assess them in the classroom. It is divided into four sections:

Introduction

- This section contains an overview of all the integrated pieces of the curriculum guide and how they work with each other (Connecting the Dots: From Seeing the Standard to Mastering It, plus a sample worksheet and Bloom's Taxonomy).
- This section also includes acknowledgments, which recognize the contributions of the scores of DC educators and others who helped develop the guides.

Tab 1: Grade-Level Standards and Learning Activities

- This section contains the learning standards for each subject and grade, supplemented by brief examples of learning activities that further clarify the meaning of the standards.
- The reading/English language arts guides also include a grade-level reading list of suggested authors and titles.

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About the Reading/English Language Arts Standards

The reading/English language arts learning standards for prekindergarten through grade 12 are organized by grade level and presented in eight strands.

Each learning standard in every grade has a unique identifier that consists of:

- *Grade level:* pre-K, K, 1, 2, 3, etc.
- *Strand:* LD = Language Development, BR = Beginning Reading, IT = Informational Text, LT = Literary Text, R = Research, W = Writing, M = Media, EL = English Language Conventions
- *Substrand category (in come cases):* such as Poetry (LT-P) and Drama (LT-D) within Literary Text
- *Standard number:* 1, 2, 3, 4, etc.

For example, standard 1.LD-V.8 is the eighth standard of the Language Development strand, is in the Vocabulary category, and should be mastered in grade 1. Standard 4.IT-A.7 is the seventh standard of the Informational Text strand, is in the Argument and Persuasive Text category, and should be mastered in grade 4.

Many of the strands have multiple categories:

Language Development (LD)
- Discussion (LD-D)
- Questioning, Listening, and Contributing (LD-Q)
- Oral Presentation (LD-O)
- Vocabulary Development (LD-V)

Beginning Reading (through grade 5) (BR)
- Print Concepts (BR-PC)
- Phonemic Awareness (BR-PA)
- Phonics (BR-P)
- Fluency (BR-F)

Informational Text (IT)
- Expository Text (IT-E)
- Document and Procedural Text (IT-DP)
- Argument and Persuasive Text (IT-A)

Literary Text (LT)
- Understanding Text (LT-U)
- Connections (LT-C)
- Genre (LT-G)
- Theme (LT-T)
- Fiction (LT-F)
- Poetry (LT-P)
- Style and Language (LT-S)
- Drama (LT-D)
- Literary Nonfiction (LT-LNF)
- Traditional Narrative and Classical Literature (LT-TN)

Research (R)

Writing (W)
- Imaginative Writing (W-I)
- Expository Writing (W-E)
- Revision (W-R)

Media (M)

English Language Conventions (EL)

About the Mathematics Standards

The mathematics learning standards for prekindergarten through grade 8 are organized by grade level and presented in five strands. High school standards are organized by course.

Each learning standard in every grade or course has a unique identifier that consists of:

- *Grade level:* Pre-K, K, 1, 2, 3, etc., or course AI = Algebra I; G = Geometry; AII = Algebra II; PS = Probability and Statistics; and PCT = Precalculus and Trigonometry
- *Strand:* NSO = Number Sense and Operations; PRA = Patterns, Relations, and Algebra; G = Geometry; M = Measurement; and DASP = Data Analysis, Statistics, and Probability
- *Substrand (in some cases):* The Number Sense and Operations strand, for instance, has four substrand categories: Number Sense (NSO-N); Fractions, Decimals, and Percents (NSO-F); Estimation (NSO-E); and Computation and Operations (NSO-C).
- *Standard number:* 1, 2, 3, 4, 5, etc.

For example, standard 4.G.6 is the sixth standard of the Geometry strand in grade 4. Standard AI.N.12 is the 12th standard of the Number Sense and Operations strand in the Algebra I course.

The five strands for prekindergarten through grade 8 are:

- Number Sense and Operations
- Patterns, Relations, and Algebra
- Geometry
- Measurement
- Data Analysis, Statistics, and Probability

The standards for grades 9 through 12 are organized under the following discipline headings:

- Algebra I
- Geometry
- Algebra II
- Probability and Statistics
- Precalculus and Trigonometry

To allow schools and teachers flexibility, the standards do not mandate that a particular high school course be initiated and completed in a single grade. For example, students could take Geometry in grade 9, 10, or 11, depending on the preferred sequence of course offerings at each high school, but all students are required to take Algebra I and Geometry to graduate. We stress that the content included in middle school through the high school courses of Algebra I and Geometry represents a minimum; it defines what will be assessed and what will be required for graduation. Students must have the opportunity to learn significantly more, including the opportunity to study proper algebra in grade 8 — if not in grade 7 — as do students in Singapore and Japan.

About the Science Standards

In the elementary grades, the standards integrate all of the major domains of science every year. At the middle and high school levels, the standards adopt a discipline-based approach. The high school science standards are written to allow for choice in course organization and sequence. Specifically:

- Prekindergarten through grade 5 is organized according to the domains of science: earth, life, and physical sciences, with standards for scientific thinking and inquiry listed separately.
- Grades 6 through 8 each focus on one of the domains: grade 6 on earth sciences, grade 7 on life sciences, and grade 8 on physical sciences. Standards are listed under key areas of study, noted by topic headings (e.g., solar system, plate tectonics).
- High school is organized by courses (e.g., Earth Science, Biology, Chemistry, Physics, and Environmental Science) and is similarly formatted around key areas of study.

Prekindergarten-Grade 1 Standards
- Scientific Thinking and Inquiry
- Earth Science
- Physical Science
- Life Science

Grades 2-5 Standards
- Scientific Thinking and Inquiry
- Science and Technology
- Earth Science
- Physical Science
- Life Science

Grade 6 Standards
- Scientific Thinking and Inquiry
- Science and Technology
- The Solar System
- Heat (Thermal Energy)
- Weather and Climate
- Resources
- The Rock Cycle
- Plate Tectonics
- Earth and Life History

Grade 7 Standards
- Scientific Thinking and Inquiry
- Science and Technology
- Biological Classification
- Cell Biology
- Genetics
- Biological Evolution
- The Human Body
- Ecology

Grade 8 Standards
- Scientific Thinking and Inquiry
- Structure of Matter
- Reactions
- Density and Buoyancy
- Conservation of Energy
- Electricity and Magnetism
- Forces
- Waves

High School Earth Science Standards
- Scientific Investigation and Inquiry
- The Universe
- The Solar System
- The Earth System
- The Hydrologic Cycle
- The Rock Cycle
- Plate Tectonics

High School Biology Standards
- Scientific Investigation and Inquiry
- Chemistry of Living Things
- Cell Biology
- Genetics
- Biological Evolution
- Plant Biology
- The Mammalian Body
- Ecosystems

(continued)

High School Chemistry Standards

- Scientific Investigation and Inquiry
- Properties of Matter
- Acids and Bases
- The Atom
- Nuclear Processes
- Chemical Bonds
- Conservation of Matter
- Gases and Their Properties
- Chemical Equilibrium
- Solutions
- Chemical Thermodynamics
- Organic and Biochemistry

High School Physics Standards

- Scientific Investigation and Inquiry
- Motion and Forces
- Conservation of Energy and Momentum
- Mechanics of Fluids
- Heat and Thermodynamics
- Waves
- Electromagnetism
- Nuclear Processes

High School Environmental Science Standards

- Scientific Investigation and Inquiry
- Environmental Systems
- Ecosystems
- Populations
- Natural Resources
- Watersheds and Wetlands
- Energy in the Earth System
- Environmental Quality

About the Social Studies Standards

The learning standards for U.S. and world history are grouped in time periods commonly accepted by historians. Essential topics that build a chronologically organized history and establish social science knowledge were selected to set standards that can be taught and mastered within a specific time frame. Teachers are encouraged to elaborate on the content outlined here, to add topics they feel are important, and to organize material thematically. They also are encouraged to enrich the classroom experience by incorporating current events and issues that have a significant relationship to important historical themes or events under study.

These standards integrate the four major disciplines of history, geography, economics, and politics and government. They are not presented in separate strands, although grade 6 focuses on geography and grade 12 focuses on government, including U.S. and Washington, DC, governments.

A coding system has been used throughout the document to indicate the disciplinary content stressed in a standard that details U.S. or world history. These include the principal disciplines of geography (G), economics (E), and politics and government (P); the characteristics of religious thought and ideas (R); and the social impact of events (S), military action (M), and intellectual thought (I) that have advanced civilizations.

Prekindergarten — People and How They Live
- People and How They Live
- Economics
- Time, Continuity, and Change
- Geography
- Civics Values and Historical Thinking

Kindergarten — Living, Learning, and Working Together
- Geography
- Historical Thinking
- Civic Values
- Personal and Family Economics

Grade 1 — True Stories and Folktales from America and around the World
- Geography
- Civic Values
- Earliest People and Civilizations of the Americas

Grade 2 — Living, Learning, and Working Now and Long Ago
- Geography
- Civic Values

Kindergarten through Grade 2 — Historical and Social Sciences
- Analysis Skills
- Chronology and Cause and Effect
- Geographic Skills
- Historical Research, Evidence, and Point of View

Grade 3 — Geography and History of the District of Columbia
- Geography of DC
- Government of DC
- Economy of the Local Region
- History of DC (18th-20th Centuries)

Grade 4 — U.S. History and Geography: Making a New Nation
- The Land and People before European Expansion
- Age of Exploration (15th-16th Centuries)
- Settling the Colonies to the 1700s
- The War for Independence (1760-1789)

Grade 5 — U.S. History and Geography: Westward Expansion to the Present
- The New Nation's Westward Expansion (1790-1860)
- The Growth of the Republic (1800-1860)
- The Civil War and Reconstruction
- Industrial America (1870-1940)
- World War II (1939-1945)
- Economic Growth and Reform in Contemporary America (1945-Present)

Grades 3–5 — Historical and Social Sciences Analysis Skills
- Chronology and Cause and Effect
- Geographic Skills
- Historical Research, Evidence, and Point of View

Grade 6 — World Geography and Cultures
- The World in Spatial Terms
- Places and Regions
- Human Systems
- Economic Systems and Urbanization
- Physical Systems
- Environment and Society

(continued)

Grade 7 — World History and Geography: Ancient World

- Era I: Early Humankind and the Development of Human Societies
- Era II: Early River Civilizations to 1000 B.C./B.C.E.
- Era III: Ancient and Classical Civilizations to 700 C.E.

Grade 8 — U.S. History and Geography I: Growth and Conflict

- Our Colonial Heritage (1600-1720)
- A New Nation (1720-1787)
- The Constitution of the United States (1777-1789)
- Launching the New Nation (1789-1849)
- The Divergent and Unifying Paths of the American People (1800-1850)
- Civil War and Reconstruction (1830-1877)
- The Rise of Industrial America (1877-1914)

Grades 6-8 — Historical and Social Sciences Analysis Skills

- Chronology and Historical Interpretation
- Geographic Skills

Grade 9 — World History and Geography I: Middle Ages to the Age of Revolutions

- Era IV: Middle Ages
- Era V: Early Modern Times to 1650
- Era VI: Age of Revolutions

Grade 10 — World History and Geography II: The Industrial Revolution to the Modern World

- Era VI: Age of Revolutions to 1914
- Era VII: The Great Wars to 1945
- Era VIII: The Cold War to the Present

Grade 11 — U.S. History and Geography II: Industrial America to the Present

- United States to the 1800s
- The Rise of Industrial America (1877-1914)
- The Progressive Era (1890-1920)
- The 1920s and 1930s
- The Great Depression (1929-1939)
- World War II (1939-1947)
- Cold War America to the New Millennium (1947-2001)
- Contemporary America

Grade 12 — Principles of U.S. Government

- Principles of U.S. Government
- Branches of Government
- Elections and the Political Process
- Rights and Responsibilities of Citizens
- Federal Government and the Economy
- Comparative Government

Grade 12 — District of Columbia History and Government

- Early Settlements and Geography
- A New National Capital and a New City
- Slavery, War, and Emancipation
- Reconstruction Period
- Late 19th and Early 20th Centuries
- 20th-Century Expansion and Urban Challenges
- Civil Rights and Home-Rule Victories
- Addressing Opportunities and Problems under Home Rule
- District Government

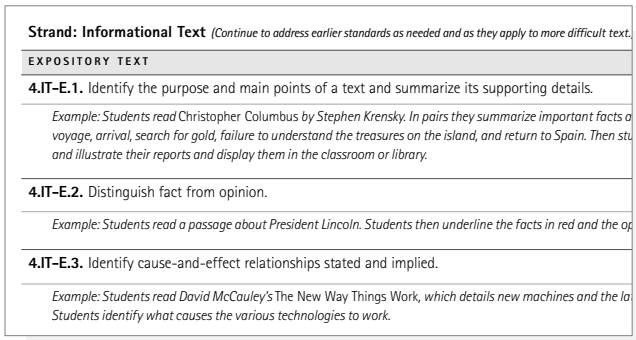
Grades 9–12 — Historical and Social Sciences Analysis Skills

- Chronology and Historical Interpretation
- Geographic Skills
- Historical Research, Evidence, and Point of View

Principles of Economics

- Economic Terms
- Market Economy
- U.S. Labor Market
- International Trade

GRADE-LEVEL STANDARDS AND LEARNING ACTIVITIES



Strand: Informational Text *(Continue to address earlier standards as needed and as they apply to more difficult text.*

EXPOSITORY TEXT

4.IT–E.1. Identify the purpose and main points of a text and summarize its supporting details.

Example: Students read Christopher Columbus *by Stephen Krensky. In pairs they summarize important facts a voyage, arrival, search for gold, failure to understand the treasures on the island, and return to Spain. Then stu and illustrate their reports and display them in the classroom or library.*

4.IT–E.2. Distinguish fact from opinion.

Example: Students read a passage about President Lincoln. Students then underline the facts in red and the op

4.IT–E.3. Identify cause-and-effect relationships stated and implied.

Example: Students read David McCauley's The New Way Things Work, *which details new machines and the la Students identify what causes the various technologies to work.*

In the first section of the curriculum guide, teachers are provided with grade-specific standards. Many contain sample learning activities (written in italics) that further clarify the meaning of the standard for teachers and students alike. The sample learning activities show how a standard might be addressed in the classroom and also provide teachers with ideas that they can develop into standards-based worksheets (described on the next page) or lesson plans. (Note: Teachers also have subject-specific guides to the standards for pre-K through grade 12, described on page 11.)

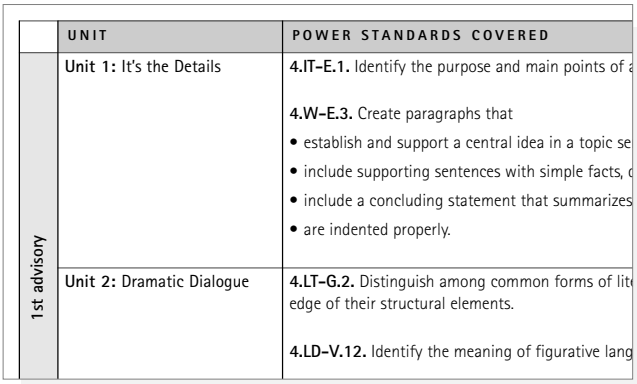
Teachers will note that in reading/English language arts and mathematics, the standards are organized according to "strands" (e.g., beginning reading, informational text, English language conventions, number sense and operations, measurement) and employ a numbering system that alerts the teacher to the strand in which a standard falls. Science and social studies use a different numbering system, built on the broad concepts around which those standards are organized.

The new learning standards are the driving force behind instruction, assessment, and staff development in DCPS.

GRADE-LEVEL YEAR AT A GLANCE CHARTS

The second section of the curriculum guide starts with a chart depicting the year at a glance. This overview has two primary purposes: (1) to identify the "power standards" in a given content area for a given grade and (2) to sequence the coverage of those power standards into instructional units that cover the school year.[1] Each year at a glance contains a grade or course overview that provides teachers with a rationale for the sequencing of the units.

Following the year at a glance are unit roadmaps and standards-based worksheets.



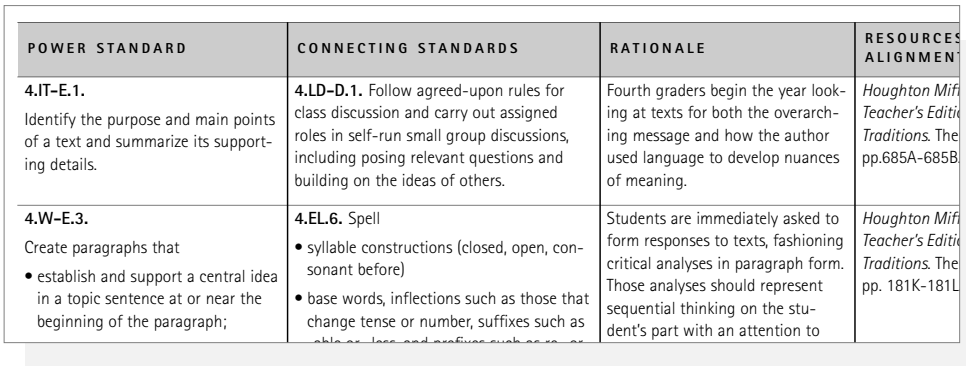
	UNIT	POWER STANDARDS COVERED
1st advisory	**Unit 1:** It's the Details	**4.IT–E.1.** Identify the purpose and main points of a **4.W–E.3.** Create paragraphs that • establish and support a central idea in a topic se • include supporting sentences with simple facts, d • include a concluding statement that summarizes • are indented properly.
	Unit 2: Dramatic Dialogue	**4.LT–G.2.** Distinguish among common forms of lit edge of their structural elements. **4.LD–V.12.** Identify the meaning of figurative lang

All standards are not equal. Some grade-level expectations stand out because they are of a higher cognitive order or encompass other skills, such as "identify the purpose and main points of a text and summarize its supporting details" (grade 4). They prepare a student for the next level of study, qualify as an enduring life skill, or relate to other domains or disciplines. Stated simply, they are standards with **"power."**

The **power standards** identified in this guide reflect frameworks of the National Assessment of Educational Progress (NAEP). They represent the essential and enduring core knowledge and skills students must have to move successfully to the next level of instruction. The power standards are also an important organizational tool for teachers; they provide direction for instruction. They assist in prioritizing and organizing the skills and knowledge that must be taught.

[1] While the year at a glance charts are organized around advisories, teachers on a "4 x 4" or other alternative schedule should move through the sequence identified, accelerating the time according to the schedule. In addition, teachers using a special curricular program — such as Springboard — should focus on the power standards and their connecting standards in a sequence that is compatible with the program. This may require variance from the outline in the year at a glance. However, the other tools in this section should be consulted and used by all teachers.

GRADE-LEVEL UNIT ROADMAPS



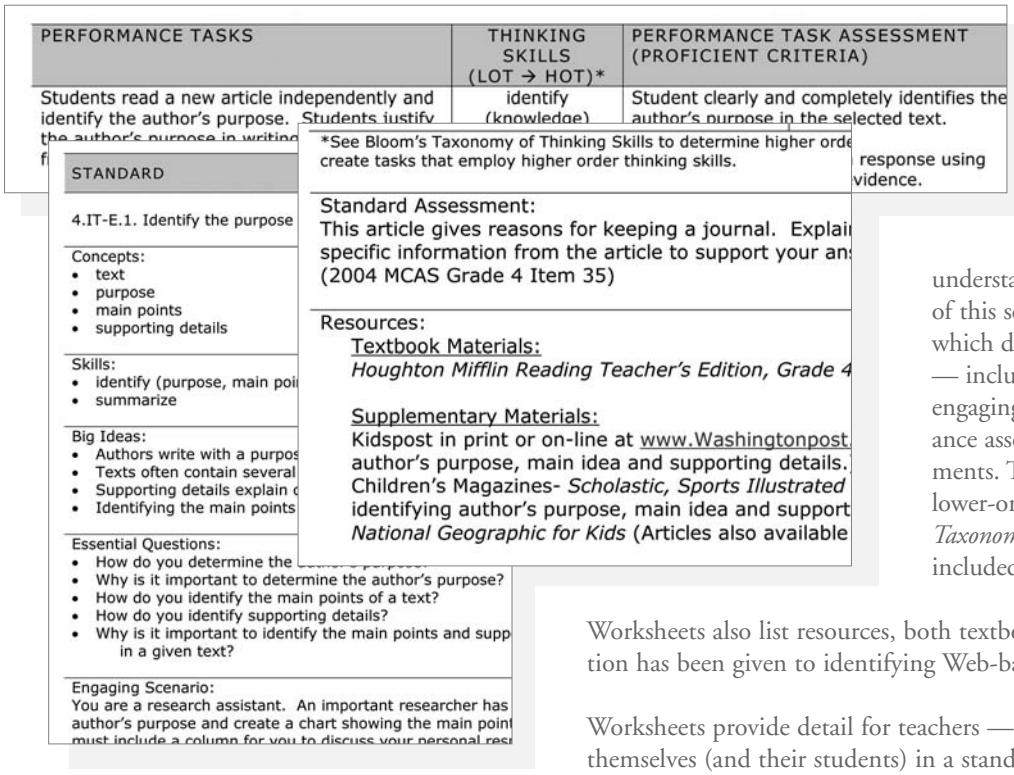
POWER STANDARD	CONNECTING STANDARDS	RATIONALE	RESOURCES ALIGNMENT
4.IT–E.1. Identify the purpose and main points of a text and summarize its supporting details.	**4.LD–D.1.** Follow agreed-upon rules for class discussion and carry out assigned roles in self-run small group discussions, including posing relevant questions and building on the ideas of others.	Fourth graders begin the year looking at texts for both the overarching message and how the author used language to develop nuances of meaning.	*Houghton Mifl Teacher's Editi Traditions.* The pp.685A-685B
4.W–E.3. Create paragraphs that • establish and support a central idea in a topic sentence at or near the beginning of the paragraph;	**4.EL.6.** Spell • syllable constructions (closed, open, consonant before) • base words, inflections such as those that change tense or number, suffixes such as	Students are immediately asked to form responses to texts, fashioning critical analyses in paragraph form. Those analyses should represent sequential thinking on the student's part with an attention to	*Houghton Mifl Teacher's Editi Traditions.* The pp. 181K-181L

Unit roadmaps group standards that support and reinforce one another into units of instruction. Grade-level unit roadmaps contain three important components:

- Identification of "connecting standards" that support, reinforce, and are relevant to the teaching and learning of the "power standards."
- A rationale for grouping particular power standards and connecting standards into instructional units, which explains how the group of standards works together, taking advantage of synergies between and among the standards.
- An indication of where in the primary textbook resource a teacher might find lessons to support the instruction.

The sequencing and grouping of power standards and connecting standards — along with the accompanying rationales — help teachers see how each standard builds on and connects to others. Organizing coherent units of instruction in this fashion will help teachers avoid the pitfall of simply moving down the list of standards or dividing the standards among the number of instructional days without regard to the varying learning demands of each standard. This approach helps to focus time, energy, and teaching appropriately and will ensure that *all* standards in a particular grade are covered in a logical and effective sequence.

A note about textbooks: Teachers will notice that units on the roadmap are not organized around the textbook; they have been uniquely organized around the DCPS standards and are independent of any naming device a teacher might be familiar with from the textbook. This is intentional. DCPS is building a curriculum that will stand on its own, independent of a particular textbook. Moreover, textbooks often have specific gaps in information and are not expected to cover all concepts and skills contained within the standards. They should be seen as resources. Using standards to guide a teacher's instruction will ensure consistency and allow for more creativity and accountability in curriculum building than following a single text.



PERFORMANCE TASKS	THINKING SKILLS (LOT → HOT)*	PERFORMANCE TASK ASSESSMENT (PROFICIENT CRITERIA)
Students read a new article independently and identify the author's purpose. Students justify	identify (knowledge)	Student clearly and completely identifies the author's purpose in the selected text.

*See Bloom's Taxonomy of Thinking Skills to determine higher orde
create tasks that employ higher order thinking skills.

response using
vidence.

STANDARD

4.IT-E.1. Identify the purpose

Concepts:
- text
- purpose
- main points
- supporting details

Skills:
- identify (purpose, main poi
- summarize

Big Ideas:
- Authors write with a purpos
- Texts often contain several
- Supporting details explain
- Identifying the main points

Essential Questions:
- How do you determine the
- Why is it important to determine the author's purpose?
- How do you identify the main points of a text?
- How do you identify supporting details?
- Why is it important to identify the main points and supp in a given text?

Engaging Scenario:
You are a research assistant. An important researcher has
author's purpose and create a chart showing the main point
must include a column for you to discuss your personal resp

Standard Assessment:
This article gives reasons for keeping a journal. Explai
specific information from the article to support your an
(2004 MCAS Grade 4 Item 35)

Resources:
Textbook Materials:
Houghton Mifflin Reading Teacher's Edition, Grade 4

Supplementary Materials:
Kidspost in print or on-line at www.Washingtonpost.
author's purpose, main idea and supporting details.
Children's Magazines- *Scholastic, Sports Illustrated*
identifying author's purpose, main idea and support
National Geographic for Kids (Articles also available

GRADE-LEVEL STANDARDS-BASED WORKSHEETS

Grade-level standards-based worksheets "drill down" on each power standard and provide the teacher with tools to better understand and teach the standard. At the end of this section, you will find a *sample worksheet,* which describes the various parts of a worksheet — including big ideas, essential questions, engaging scenarios, performance tasks, performance assessments, and standards-based assessments. The worksheets discuss higher-order and lower-order thinking skills, based on *Bloom's Taxonomy.* A copy of Bloom's Taxonomy also is included after the sample worksheet.

Worksheets also list resources, both textbook and supplemental. Specific attention has been given to identifying Web-based supplemental resources.

Worksheets provide detail for teachers — giving them the means to immerse themselves (and their students) in a standard, dissecting and unwrapping it to result in greater mastery by students.

GRADE-LEVEL SAMPLE ASSESSMENT ITEMS

Grade-level sample assessment items are drawn from the National Assessment of Educational Progress (NAEP, commonly referred to as the "nation's report card") and various state assessments that are highly regarded for their rigor. They are included to inform the teacher about the types of test items students may have at the end of the year on both the NAEP and the DC Comprehensive Assessment System (DCCAS). They offer teachers and students another perspective on the standard and what it means. As sample assessment items from the DCCAS are released, they will be added to this guide.

The Box in the Barn

by Barbara Eckfeld Conner

Jason heard his mom calling him. Instead of answering her, he slipped deeper into the tall weeds behind his house. He closed his eyes, thinking of what he had done.

He had gotten up that morning in a good mood. Raspberry pancakes were on the table when he walked into the kitchen rubbing his eyes and yawning.

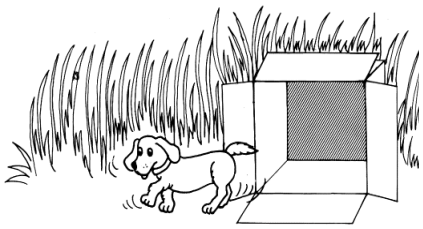
"After breakfast, Jason, I want you to go into town with me," Mom said quietly. "It's your sister's birthday, and we need to shop for her gifts."

Jason was eager to go, even if the gifts weren't for him. Buying presents was always fun.

own, Jason couldn't help but ask the question
mind since yesterday when Aunt Nancy
e big box that Dad took to the barn, Mom?
Nancy bought for Megan's birthday?"
, and I don't want you going near that barn
me?"
the road ahead. He knew that nothing would
nly now he was more curious than ever!
n ran out to meet Jason, her eyes wide and
n, I'm six years old!" she cried, jumping up

Jason gave her a big hug.

as buzzing with excitement. Megan sat on
while Mom and Aunt Nancy prepared the
d wouldn't be back for at least two hours.
side trying to think of something to do, but
turning to the box in the barn.
g toward the barn, not at all sure what he'd
e. He was hoping for just a glimpse of the
d a strange noise coming from inside the



INFORMATIONAL TEXT

When Megan spoke to Jason in the tall weeds, she was concerned that

A. she wouldn't get enough presents

B. her dad wouldn't get back in time for the party

C. something was wrong with Jason

D. the puppy was missing from the box

INFORMATIONAL TEXT

Which best describes Jason's father?

A. Strict and unwilling to listen to Jason

B. Understanding and patient with Jason

C. Curious and puzzled by the empty box

D. Angry and sad that Jason hid

SUBJECT-SPECIFIC PRE-K THROUGH GRADE 12 GUIDES

These guides, one for each subject, list *all* the standards in a specific content area. The standards specify what students should know and be able to do at the end of each grade level or course. Seeing the progression of skills across the grades is an important tool for teachers. In this standards guide, a teacher can see what students were taught and should have mastered in earlier grade(s) as well as what they are expected to learn and know in subsequent years through the 12th grade.

Grade X Standards-Based Worksheet

District of Columbia Public Schools — Subject

STANDARD

A *standard* is a statement of what students should know and be able to do at each grade level. Depending on the content area, there are typically 35 to 60 standards per grade. For purposes of helping teachers prioritize and organize instruction, standards are identified as "power" or "connecting."

Power standards and connecting standards are grouped together to create units of instruction. The *standards-based worksheet* is designed to support instruction at the individual standard level. Teachers should use the worksheet to guide a series of classroom activities that reinforce mastery of the concepts and skills embedded in the standard.

The worksheets in this guide are exemplars and focus exclusively on the power standards contained in each of the instructional units. Teachers are encouraged to develop their own worksheets for connecting standards, based on these examples.

The standard, and its number, should be listed on the worksheet.

Concepts:

Concepts are ideas and information that students need to know. They are listed as the nouns in the standard statement.

Identifying concepts (and skills, below) is part of a systematic process of "unwrapping standards," which helps teachers to develop a deeper understanding of the standard when planning instruction and assessment. Listing these concepts can help the teacher to develop activities and assessments that relate to the standard.

All concepts (i.e., nouns) in the standard should be listed in bullet form.

Skills:

Skills are what students are expected to do to demonstrate mastery of the concepts and content. They are listed as the verbs in the standard statement. A single skill may apply to multiple concepts.

By listing these skills, teachers begin to see and understand how they correlate to Bloom's Taxonomy of thinking skills, which teachers will use when planning performance tasks and assessments within the engaging scenario (below).

All skills (i.e., verbs) in the standard should be listed in bullet form. When a skill applies to multiple concepts, the concepts are listed in parentheses after the skill.

Big Ideas:

Big ideas are statements derived from a deep understanding of the concepts or content; they are enduring ideas that can apply to more than one area of study and can be the answer to the essential questions (below).

Big ideas provide a broad perspective, purpose, and rationale. They are what we want students to discover and remember long after instruction ends, such as "authors write with a purpose" in the accompanying grade 4 reading/English language arts sample worksheet. They explain what students are doing, as well as how and why it relates to larger ideas.

Big ideas should be bulleted, stated clearly and simply, and in the teacher's voice. Three or four should be identified for each standard.

Essential Questions:

Essential questions focus on conceptual and factual understandings to be investigated within the big idea. They are open-ended and communicate the fundamental and crucial elements of the content. For example (from the accompanying grade 4 reading/English language arts sample worksheet): "How do you identify the main points of a text?"

Essential questions help students reflect on their learning before, during, and after classroom instruction so that the students find themselves working with the big ideas in their own words. They are meant to engage inquiry and raise important conceptual or philosophical issues. They should be shared with the student at the beginning of instruction and should guide the teacher in the development of performance tasks.

Essential questions should mostly be "how" or "why" (vs. "what"). A minimum of four questions should be developed and listed for each standard.

Engaging Scenario:

An *engaging scenario* is the "hook" into a series of performance tasks (below) designed to attract and hold student interest. For example (from the accompanying grade 4 reading/English language arts sample worksheet): "A research assistant is required to summarize an article for his/her boss." It sets the context for the series of tasks and connects learning to the real world.

In an engaging scenario, students are learning practical skills and concepts in a relevant context that encourages the learner to think, reflect, and decide. Students begin the series of performance tasks within the engaging scenario after they have experienced some instruction to introduce them to the big ideas and essential questions. The most effective engaging scenarios often are collaborative and project based, giving students multiple paths for completing the performance tasks.

Teachers should describe the engaging scenario or context for the performance tasks. Teachers are encouraged to use a real-world setting where students are required to enter a "role" to complete the tasks.

PERFORMANCE TASKS	THINKING SKILLS (LOT→HOT)*	PERFORMANCE TASK ASSESSMENT (PROFICIENT CRITERIA)
Performance tasks are a collection of related activities or projects that allow students to show their understanding of the standard. *Performance tasks:* • are meaningful, • require a range of skills, • require students to create a response to a problem, and • require students to explain or defend their response, rather than simply select an answer from a ready-made list. Performance tasks are specific, measurable student-centered activities that ask students to apply the skills and concepts they have learned. Performance tasks should be varied to meet individual students' learning styles and needs. They should allow students to develop and apply a range of knowledge and skills (e.g., an essay, theatrical performance, etc.). These tasks should be listed separately as individual components of the engaging scenario or as steps that allow students to complete the demands of a comprehensive scenario.	In this column, educators indicate how the tasks are categorized on Bloom's Taxonomy of educational objectives. Teachers should strive to ensure that there is a balance of higher-order and lower-order thinking skills. Generally, the performance tasks should range in emphasis from lower-order thinking skills (LOTS) to higher-order thinking skills (HOTS). For Bloom's Taxonomy: http://eduscapes.com/tap/topic69.htm	Each performance task has a correlating assessment, which clearly tells students what proficiency in completing the performance requires. The performance task assessment is a specific rubric or guide used to determine the student's progress on completing the task. Because each performance task is a specific, measurable, student-centered assignment, it is important for students to know how they are expected to perform in completing the task. Rather than develop a complete rubric, this column should record only the proficient criteria for each performance task. Educators should use the proficient criteria as a benchmark that they will share with students — or allow students to reflectively determine.

Standard Assessment:

The *standards assessment* evaluates students' understanding of skills and concepts found in the standard. The standards assessment should focus attention on directly measuring mastery of the content standard (as opposed to a performance task assessment, which tests how well a student can *apply* specific concepts and skills).

Examples of standards assessments include sample released items on criterion-referenced or standardized tests, chapter or unit tests from textbooks, or teacher-generated test questions.

Resources:

Textbook Materials:

Supplementary Materials:

Resources should support educators' planning by recommending primary and supplemental materials adopted by the district, as well as resources that may not be available in each local school but are easily accessible. From these resources, educators may develop the specific activities to teach the standard's embedded skills and concepts. Recommendations for implementation of instructional technology also may be noted in this space.

Grade 4 Unit 1 Standards-Based Worksheet

District of Columbia Public Schools – Reading/English Language Arts

STANDARD
4.IT-E.1. Identify the purpose and main points of a text and summarize its supporting details.

Concepts:
- text
- purpose
- main points
- supporting details

Skills:
- identify (purpose, main points)
- summarize

Big Ideas:
- Authors write with a purpose.
- Texts often contain several main points.
- Supporting details explain or support the main points.
- Identifying the main points and supporting details yields comprehension.

Essential Questions:
- How do you determine the author's purpose?
- Why is it important to determine the author's purpose?
- How do you identify the main points of a text?
- How do you identify supporting details?
- Why is it important to identify the main points and supporting details in a given text?

Engaging Scenario:
You are a research assistant. An important researcher has asked you to read and study an article, explain the author's purpose and create a chart showing the main points and supporting details of each article. Your chart also must include a column for you to discuss your personal response and any questions the text provoked in your mind. You will present your chart in small groups for discussion before submitting it to the lead researcher.

PERFORMANCE TASKS	THINKING SKILLS (LOT → HOT)*	PERFORMANCE TASK ASSESSMENT (PROFICIENT CRITERIA)
Students read a new article independently and identify the author's purpose. Students justify the author's purpose in writing, using evidence from the text.	identify (knowledge) LOT use evidence (synthesis) HOT justify (evaluation) HOT	Student clearly and completely identifies the author's purpose in the selected text. Student justifies the given response using direct text quotations as evidence.
Students read an article independently, identifying main points by labeling them with post-it notes. Students meet in small group to compare and explain their choices.	identify (knowledge) LOT compare & explain (analysis) HOT	Student correctly identifies and labels at least two main points in the selected text. Student uses direct text quotations to explain and compare their identification of the article's main points.
Students read a non-fiction text determining Main Points and Supporting Details and recording them in a chart as they read.	record (knowledge) LOT determine (application) LOT	Student correctly determines at least two main points. Student correctly determines at least three details for each main point. Student records responses in an orderly manner on the chart.

Students formulate personal responses to the text and generate questions about the text, recording all responses in writing.	formulate (synthesis) HOT generate questions (evaluation) HOT record (knowledge) LOT	Student formulates at least three personal responses. Student generates at least two questions. Student records all responses in their proper locations on the chart in a clear and orderly manner.

*See Bloom's Taxonomy of Thinking Skills to determine higher order thinking skills (HOT) or lower order thinking skills (LOT). The goal is to create tasks that employ higher order thinking skills.

Standard Assessment:
This article gives reasons for keeping a journal. Explain THREE reasons for keeping a journal, using important and specific information from the article to support your answer.
(2004 MCAS Grade 4 Item 35)

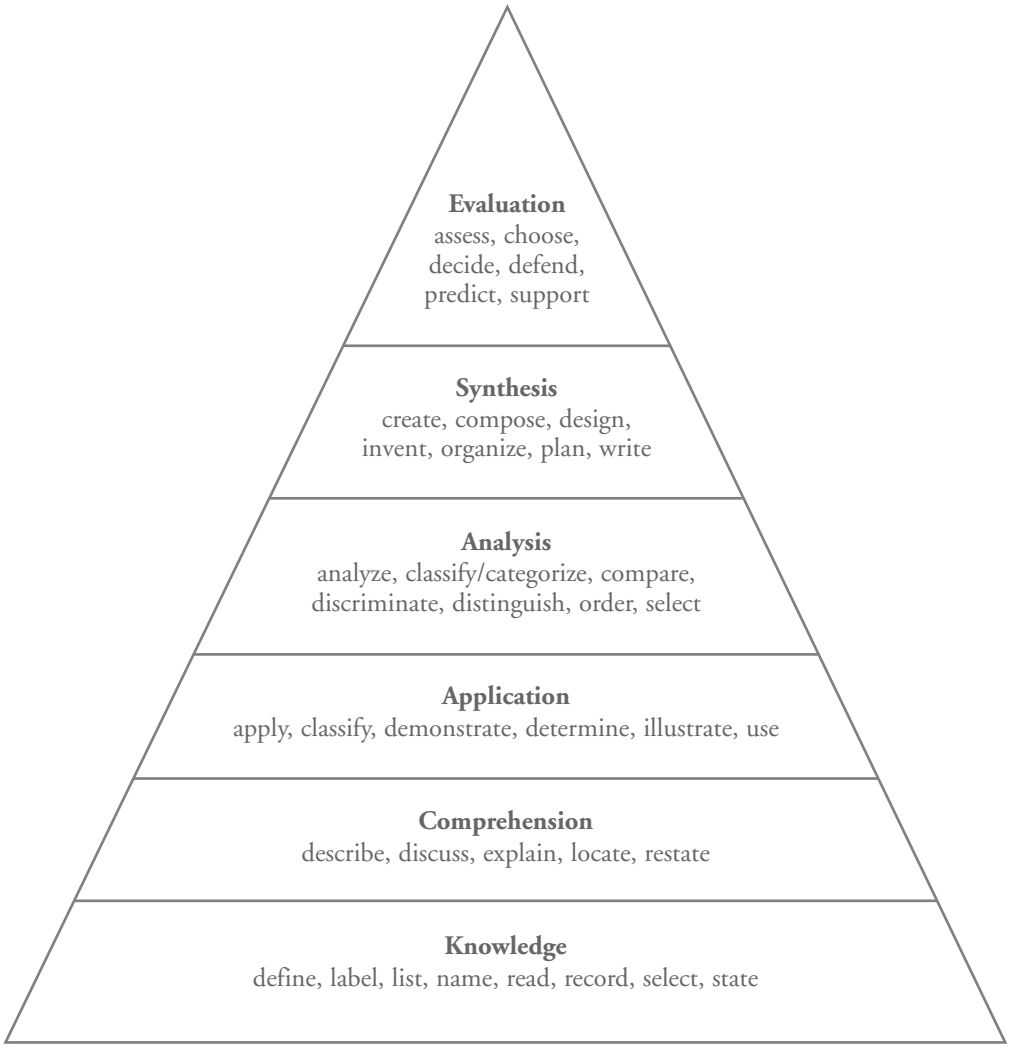
Resources:

Textbook Materials:
Houghton Mifflin Reading Teacher's Edition, Grade 4, Traditions. Theme 6 pp.685A-685B.

Supplementary Materials:
Kidspost in print or on-line at www.Washingtonpost.com (Contains non-fiction articles suitable for identifying author's purpose, main idea and supporting details.)
Children's Magazines- *Scholastic, Sports Illustrated for Kids* (High-interest non-fiction texts suitable for identifying author's purpose, main idea and supporting details.)
National Geographic for Kids (Articles also available on-line at www.nationalgeographic.com/kids.)

Bloom's Taxonomy

In 1956, Benjamin Bloom developed a classification for categorizing the level of abstraction of questions that commonly occur in educational settings, referred to as Bloom's Taxonomy. Bloom identified six levels within the cognitive domain, from the simple recall or recognition of facts (the lowest level), through increasingly more complex and abstract mental levels, to the highest order, which is classified as evaluation. When we talk about HOTS (higher-order thinking skills), we are concentrating on the top three levels of Bloom's Taxonomy. When we talk about LOTS (lower-order thinking skills), we are concentrating on the bottom three levels of Bloom's Taxonomy. Each individual box below lists verbs that correspond to a specific level of thinking, providing a useful structure in which to categorize performance tasks and performance assessments. The specific verbs indicated are not intended to be an exhaustive list but rather examples of what might be expected within each domain.



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Tab 2: Grade-Level Year at a Glance, Unit Roadmaps, and Standards-Based Worksheets

- This section contains a chart depicting the year at a glance, which identifies the "power standards" for each subject and grade, groups those power standards into instructional units, and suggests when during the school year the units should be the focus of instruction.
- The section also contains unit roadmaps, which group "power standards" and "connecting standards" together into units of instruction. The roadmaps also include a rationale for the grouping, plus cross-references to the primary textbook and other resources.
- Finally, standards-based worksheets provide additional detail about each "power standard" and how it might be taught, including big ideas, essential questions, engaging scenarios, performance tasks, performance assessments, and standards-based assessments.

Tab 3: Grade-Level Sample Assessment Items

- This section contains sample test items for each subject and most grades; in future years there will be sample assessment items for all grades. These test questions will help teachers, students, and others better understand how the learning standards will be measured.

This guide is a work in progress. Teachers, administrators, and curriculum writers will be developing and disseminating additional material for sections 2 and 3 as the school year continues.

For additional information about these materials, please contact the Office of Academic Services at 202-442-5599.

ABOUT THE ORDER

Each section of the *grade-specific* guides organizes the subjects in the following order: reading/ English language arts, mathematics, science, and social studies.

Each section of the *subject-specific* guides organizes the material chronologically by grade: kindergarten, followed by grade 1, grade 2, grade 3, etc.

Section 1: Grade-Level Standards and Learning Activities

Grade-Level Standards and Learning Activities

This section provides teachers with grade-specific standards. Many contain sample learning activities (written in italics) that further clarify the meaning of the standard for teachers and students alike. The sample learning activities show how a standard might be addressed in the classroom and also provide teachers with ideas that they can develop into standards-based worksheets (described in Tab 2) or lesson plans. (Note: Teachers also have subject-specific guides to the standards for pre-K through grade 12, which show the progression of skills across the grades.)

Teachers will note that in reading/English language arts and mathematics, the standards are organized according to "strands" (e.g., beginning reading, informational text, English language conventions, number sense and operations, measurement) and employ a numbering system that alerts the teacher to the strand in which a standard falls. Science and social studies use a different numbering system, built on the broad concepts around which those standards are organized.

Probability and Statistics Standards and Learning Activities

PS.1. Demonstrate understanding of the definition of the notion of independent events and use the rules for addition, multiplication, and complementation to solve for probabilities of particular events in finite sample spaces.

Example: If you draw two cards at random from a standard deck of 52 cards, what is the probability that both are hearts? Now draw a third card. What is the probability that the third card is a heart if the first two were already hearts?

PS.2. Know the definition of conditional probability, and use it to solve for probabilities in finite sample spaces.

Example: Roll two dice.

What is the probability that the sum of the faces is even?

What is the probability that the result is a pair?

What is the probability that you have a pair if the sum is even?

PS.3. Demonstrate understanding of the notion of discrete random variables by using them to solve for the probabilities of outcomes (e.g., the probability of the occurrences of five heads in 14 coin tosses).

Example: Toss a coin 15 times and let X *denote the number of times that the result is "heads". Compute each of the following probabilities:*

A. $P(X = 0)$

B. $P(X > 0)$

C. $P(X = 1)$

PS.4. Apply uniform, normal, and binomial distributions to the solutions of problems.

Example You are about to take a quiz with 4 true-false questions. What is the probability that you will get at least 3 out of 4 correct if you make a random guess on each question?

Example: If Z *is a normal random variable with mean 0 and standard deviation 1, what is the probability that* Z *is greater than 0?*

Example: If Z *is a normal random variable with mean 0 and standard deviation 1, compute* $P(|Z| < 1)$.

Example: Quality control for a manufacturing process measures the weight of parts at the end of the production line. The weights follow a normal distribution with mean weight 45 ounces and standard deviation 0.5 ounces. One part is chosen at random for testing. What is the probability that this part will weigh more than 46 ounces?

PS.5. Determine the mean and the standard deviation of a normally distributed random variable.

PS.6. Know the definitions of the mean, median, and mode of a distribution of data, and compute each in particular situations.

Example: Give an example of a small data set (3 or more data points) for which the mean is greater than the median.

A class of 25 students is asked to determine approximately how much time the average student spends on homework during a one-week period. Each student is to ask one of his/her friends for the information, making sure that no one student is asked more than once. The numbers of hours spent on homework per week are as follows:

8, 0, 25, 9, 4, 19, 25, 9, 9, 8, 0, 8, 25, 9, 8, 7, 8, 3, 7, 8, 5,

3, 25, 8, 10

Example: Find the mean, median, and mode for these data. Explain or show how you found each answer.

Example: Based on this sample, which measure (or measures) that you found in part a best describes the typical student? Explain your reasoning.

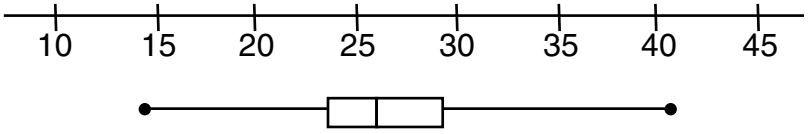
Example: Describe a sampling procedure that would have led to more representative data.

(See also PS.7, PS.8)

PS.7. Describe a set of frequency distribution data by spread (variance and standard deviation), skewness, symmetry, number of modes, or other characteristics. Use these concepts in everyday applications.

PS.8. Organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatter plots, and box-and-whisker plots.

Example: The box-and-whisker graph shown below represents the results of a survey of the estimated gas mileage of 100 car models.



What is the median gas mileage?

What are the best and worst gas mileages in the survey?

What range contains about 50% of the outcomes?

PS.9. Describe and explain how the relative sizes of a sample and the population affect the validity of predictions from a set of data.

PS.10. Approximate a line of best fit (trend line) given a set of data (e.g., scatter plot).

Section 2: Year at a Glance, Unit Roadmaps, and Standards-Based Worksheets

Year at a Glance, Unit Roadmaps, and Standards-Based Worksheets

This section contains three sets of tools teachers can use in planning their instruction:

Year at a Glance

This overview has two primary purposes: (1) to identify the "power standards" in a given content area for a given grade and (2) to sequence the coverage of those power standards into instructional units that cover the school year. Each year at a glance contains a grade or course overview that provides teachers with a rationale for the sequencing of the units.

Grade-Level Unit Roadmaps

The roadmaps group standards that support and reinforce one another into units of instruction. Grade-level unit roadmaps contain three important components:

- Identification of "connecting standards" that support, reinforce, and are relevant to the teaching and learning of the "power" standards.
- A rationale for grouping particular "power standards" and "connecting standards" into instructional units, which explains how the group of standards works together, taking advantage of the synergies between and among standards.
- An indication of where in the primary textbook resource a teacher might find lessons to support the instruction.

Grade-Level Standards-Based Worksheets

The worksheets "drill down" on each power standard and provide the teacher with tools to better understand and teach the standard. Each worksheet covers several issues — big ideas, essential questions, engaging scenarios, performance tasks, performance assessments, and standards-based assessments. The worksheets also list resources, both textbook and supplemental. Specific attention has been given to identifying Web-based supplemental resources.

These worksheets provide detail for teachers — giving them the means to immerse themselves (and their students) in a standard, dissecting and unwrapping it to result in greater mastery by students.

Probability and Statistics at a Glance

District of Columbia Public Schools — Mathematics

COURSE OVERVIEW: Sequencing for this set of standards is guided by the natural flow of the information students must have to reach a level of competence with statistical analysis and probability. Advisory 1 begins with students learning various ways to display data sets and describe them using measures of center (mean, median, mode). Students then examine measures of spread, such as standard deviation and normal distributions. Advisory 2 opens with conditional probability; defining and computing in finite sample spaces, including the concept of complementation, independent events, and combinations of probabilities. This is followed by an investigation of distributions, including uniform, binomial, and normal, which refers back to Advisory 1's work with normally distributed data analysis. This last concept also includes an understanding of discrete random variables as they relate to probability outcomes. Finally, the semester ends with students learning about regression models and their predictive ability.

	UNIT	POWER STANDARDS COVERED
1st advisory	**Unit 1:** Analyze This	**PS.8.** Organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots. **PS.5.** Determine the mean and the standard deviation of a normally distributed random variable.
2nd advisory	**Unit 2:** What's Probable, What's Possible	**PS.2.** Know the definition of conditional probability, and use it to solve for probabilities in finite sample spaces. **PS.4.** Apply uniform, normal, and binomial distributions to the solutions of problems.
	Unit 3: Make It Fit	**PS.10.** Approximate a line of best fit (trend line) given a set of data (e.g., scatterplot).

Probability and Statistics Unit 1 Roadmap: Analyze This — Advisory 1

POWER STANDARD	CONNECTING STANDARDS	RATIONALE	RESOURCES (TEXTBOOK ALIGNMENT)*
PS.8. Organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots.	**PS.6.** Know the definitions of the mean, median, and mode of a distribution of data, and compute each in particular situations.	The year opens with a focus on displaying and describing data using measures of central tendency.	*Elementary Statistics*, Triola, Sections 2.3 and 2.7, Appendix B, Data Set 21, p. 772. *Springboard Algebra 1*, The College Board, Olympic Hoops.
PS.5. Determine the mean and the standard deviation of a normally distributed random variable.	**PS.7.** Describe a set of frequency distribution data by spread (variance and standard deviation), skewness, symmetry, number of modes, or other characteristics. Use these concepts in everyday applications.	Following the use of central tendency, students turn their attention to frequency distributions and measures of spread. Here, the study gets a little more formal and rigorous.	*Elementary Statistics*, Triola, Sections 2.2–2.5, Appendix B, Data Set 23, p. 774. *Springboard Algebra 1*, The College Board, A 60-Minute Instant.

**For additional resources, see Standards-Based Worksheets.*

Probability and Statistics Unit 1 Standards-Based Worksheet

District of Columbia Public Schools — Mathematics

STANDARD

PS.8. Organize and describe distributions of data using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatter plots, and box-and-whisker plots.

Concepts:

- distributions of data
- frequency table
- histogram
- line graph
- bar graph
- stem-and-leaf display
- scatter plot
- box-and-whisker plot

Skills:

- organize (distributions of data)
- describe (distributions of data)

Big Ideas:

- Displaying data in graphic form is a powerful tool for data analysis: a picture *is* worth a thousand words.
- Data can be displayed in many ways and for different purposes.
- The best data display to use often depends on the purpose—describing, exploring, summarizing, or comparing data sets.
- New ways to display data are always being developed.

Essential Questions:

- Which data displays are best for categorical data?
- Which data displays are best for quantitative data?
- How does the "area principle" influence the way people perceive a data display?
- What are the advantages of using each type of data display?
- How does a scatter plot differ from other types of data displays?

Engaging Scenario:
You are a movie producer at Glitter Studios. An assistant has collected data on 36 randomly chosen movies (Data Set 21 in *Elementary Statistics,* p. 772) to help you put together an impressive presentation for the studio's Board of Directors that demonstrates your thorough knowledge of the movie industry: trends in moviemaking over time, movie finances, the type of movie viewers appreciate, and so on. Using each of the six types of data:

1. Describe three appropriate forms of data display that could be used to represent the data. Select one form for each data set and construct the display.
2. Write and then answer at least two questions that you think the Board of Directors might ask you after reviewing your data.

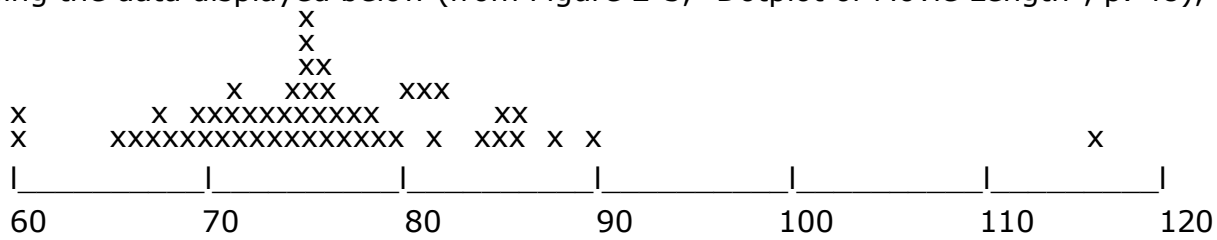
PERFORMANCE TASKS	THINKING SKILLS (LOT → HOT)*	PERFORMANCE TASK ASSESSMENT (PROFICIENT CRITERIA)
For each data set (year, rating, budget, gross, length, viewer rating) student selects three appropriate forms of data display.	select (analysis) HOT	Determines three forms for each data set among choices reserved for categorical data, such as ratings (pie chart, bar graph, pareto chart), choices reserved for ordered data, such as year (dot plot, time-series graph), data for which data range allows retention of original figures in stem-and-leaf plot (length in minutes, viewer rating). Suggested answers: Years: dot plot, time series, bar graph Type: pie and pareto chart, bar graph Budget and Gross: histogram, relative frequency histogram, boxplot Length: histogram, relative frequency histogram, stem-and-leaf and box plot Viewer rating: histogram, relative frequency histogram, stem-and-leaf and box plot.

Student constructs one of the selected forms of data display for each data set.	construct (application) LOT	Each chart, plot or graph is an effective and accurate representation of the data's features. Depending on the choice: area principle observed, appropriate number of classes chosen, scales of proper dimension and of equal intervals, labels succinct but informative, five-number summary statistics calculated accurately.
Student formulates two questions that can be answered using the appropriate data displays.	formulate (synthesis) HOT	Identified questions capture the most salient data feature. That feature may connect to distributions (such as the minimum and/or maximum values or the mode or other measure of central tendency), or the proportion of the total represented by a type of data value. Questions show that students can distinguish between categorical data for which a question can pertain to relative share of the total (e.g. "What is the most common rating?) and quantitative data for which questions pertaining to central tendencies and variation are relevant (e.g. "What is the median length of a movie?).
Student determines the answers to the questions pertaining to the appropriate data displays.	determine (application) LOT	Uses data displays to answer the questions accurately.

*See Bloom's Taxonomy of Thinking Skills to determine higher order thinking skills (HOT) or lower order thinking skills (LOT). The goal is to create tasks that employ higher order thinking skills.

Standard Assessment:

1) Using the data displayed below (from Figure 2-5, "Dotplot of Movie Length", p. 48), construct a boxplot:



(*The Practice of Statistics*, W.H. Freeman and Company, p. 46)

2) Using the same data on movie length, construct an ogive. Use the ogive to determine the number of movies that are 80 minutes or fewer in length.

(*Stats: Modeling the World*, Pearson Prentice Hall, p. 124.)

3) Data below describes the ages of actors and actresses who have been awarded an Oscar. Create two pie charts for this data specifying the criteria you used to change the quantitative data on age to categorical data suitable for a pie chart.

Actors: 32 37 36 32 51 53 33 61 35 45 55 39 76 37 42 40 32 60 38 56 48 48 40 43 62 43 42 44 41 56 39 46 31 47 45 60 46 40 36

Actresses: 50 44 35 80 26 28 41 21 61 38 49 33 74 30 33 74 30 33 41 42 37 26 34 34 35 26 61 60 34 24 30 37 31 27 39 34 26 25 33

(*Elementary Statistics*, problem #34, p. 59)

Resources:

Textbook Materials:

Elementary Statistics, Triola, Sections 2.3 and 2.7, Appendix B, Data Set 21 (p. 772).

Springboard Algebra 1, The College Board, Olympic Hoops.

Supplementary Materials:

The Visual Display of Quantitative Information, Edward R. Tufte, (Cheshire, CT: Graphics Press, 1983) (This highly-regarded book contains a classic collection of the best and worst statistical graphics.)

http://www.stat.sc.edu/~west/javahtml/Histogram.html (Changing class ("bin") sizes can have a dramatic effect on the shape of a histogram. Making the appropriate choice is a skill honed by practice. This applet allows students to experiment and see the results of their choices.)

http://www.math.yorku.ca/SCS/Gallery/milestone (This website, entitled "Milestones in the History of Thematic Cartography, Statistical Graphs, and Data Visualization" is an on-line alternative to the Tufte book mentioned above. Teacher directions would be necessary, however, for students to navigate it effectively.)

STANDARD

PS.5. Determine the mean and the standard deviation of a normally distributed random variable.

Concepts:
- mean
- standard deviation
- normally distributed random variable

Skills:
- determine (mean)
- determine (standard deviation)
- assess (whether data distribution is normal)

Big Ideas:
- A normal distribution with a unimodal, symmetric shape is the bedrock of statistics.
- The "mean" describes the center and the "standard deviation" describes the spread of any distribution.
- Data from small samples can give insight into characteristics of large populations.
- Normal distributions are found in many populations.

Essential Questions:
- How do we calculate the standard deviation?
- Why do we care about the central tendency of data as expressed in the "mean"?
- Why do we care about the variation of data as expressed in the "standard deviation"?
- How can we determine if a distribution of data is "normal"?
- In normally distributed data, how can we relate the mean, median, and mode?
- Why does all normally distributed data share a common break-down of percentages of data clustering around the mean?

Engaging Scenario:
You want to be hired by the District of Columbia to do statistical analysis for a household garbage recycling project. Data hasn't yet been collected for District households, but data collected by the University of Arizona (Appendix B, Data Set 23, p. 774 of your textbook) contains data you will use in your job interview.

As part of the interview you are asked to determine whether the distribution of total household garbage in pounds per household is normally distributed. Using the data for households #1-30, determine the nature of the distribution of total garbage weight and describe it completely in both quantitative terms and qualitative terms connected to the center and spread; use this information to defend your reasoning on whether or not the distribution is normal.

PERFORMANCE TASKS	THINKING SKILLS (LOT → HOT)*	PERFORMANCE TASK ASSESSMENT (PROFICIENT CRITERIA)
Students produce a histogram of data using appropriate sorting, creation of classes, tallying, labeling.	produce (application) HOT	Histogram has axes labeled, title, and approximately 11 classes to cover the data range from 4-52 lbs. per household.
Students calculate the mean, median and mode.	calculate (application) HOT	Calculates mean = 29.764 Calculates median = 29.43 Calculates mode = 44.4. Calculations are accurate to at least 1 decimal place.
Students assess whether determining the mode would provide useful information.	assess (evaluation) HOT	The mode is 44.4, but observation should be made that this is *not* useful and actually distorts the valid observation that more households have garbage in the 20-25 lb. per week class than any other class. *(Note: The histogram is "bimodal" and students might observe that this description is useful even if determining the mode of the original data set is not.)*

Students calculate the standard deviation of the data. As a checkpoint on accuracy, students do so first using only the mean and standard deviation of the initial five values. They then use all 30 values.	calculate (application) HOT	Calculates and rounds standard deviation to 10.187 (mean: 24.866). Calculates and rounds standard deviation to 11.971 when using all 30 values.
Students use the mean and the standard deviation to analyze the distribution: does it meet the quantitative standards of the "empirical rule" for a normal distribution? With this analysis and a qualitative analysis of the shape, the student decides if the distribution is normal.	decide (evaluation) HOT	Using the proper percentages of total "n", determine that the expected number of data values are within 1 (20 expected, 20 found) and then 2 (29 expected, 29 found) standard deviations of the mean. (Only 1 data value – the lowest -- is outside of these boundaries.) Student should explicitly refer to the "empirical rule" when stating that the distribution is normal in quantitative terms. Student's conclusions should be more tentative in a qualitative analysis, since the distribution is relatively symmetric, but bimodal.

*See Bloom's Taxonomy of Thinking Skills to determine higher order thinking skills (HOT) or lower order thinking skills (LOT). The goal is to create tasks that employ higher order thinking skills.

Standard Assessment:

1) A patient visiting a clinic six times has phosphate levels in his blood recorded as: 5.6, 5.2, 4.6, 4.9, 5.7, and 6.4 milligrams per deciliter. Find the mean and standard deviation of these blood phosphate levels.

2) Environmental Protection Agency (EPA) fuel economy estimates for automobile models tested recently predicted a mean of 24.8 miles per gallon (mpg) and a standard deviation of 6.2 mpg for highway driving. Assume there is a normal distribution of mpg values.

    a. Draw the model for auto fuel economy. Clearly label it and show what the "empirical rule" predicts about mpg.
    b. In what interval would you expect the central 68% of autos to be found?
    c. About what percent of autos should get more than 31 mpg?
    d. About what percent of cars should get between 31 and 37 mpg?
    e. Describe the gas mileage of the worst 2.5% of all cars.

Resources:

Textbook Materials:

Elementary Statistics, Triola, Sections 2.2 – 2.5, and Appendix B, Data Set 23 (p. 774).
Springboard Algebra 1, The College Board, A 60-Minute Instant.

Supplementary Materials:

http://www.stattucino.com/berrie/dsl/index.html (This applet allows manipulation of the mean and standard deviation – note that these are expressed as μ and σ -- to generate a variety of normal curves.)

http://javaboutigue.internet.com/BallDrop/ (Video demonstrates how a random ball drop results in a ball accumulation that has a normal distribution.)

Section 3: Sample Assessment Items

Sample Assessment Items

The sample assessment items are drawn from the National Assessment of Educational Progress (NAEP, commonly referred to as the "nation's report card") and various state assessments that are highly regarded for their rigor. They are included to inform the teacher about the types of test items students may have at the end of the year on both the NAEP and the DC Comprehensive Assessment System (DCCAS).

The sample assessment items offer teachers and students another perspective on the standard and what it means. As sample assessment items from the DCCAS are released, they will be added to this guide.